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Surveying deer wintering areas in WMUs 36-94 and estimating carrying capacity in major deer yards in WMUs 36-63 and 83:

Plan for implementation and funding.

Ontario Ministry of Natural Resources
Science Development and Transfer
Southcentral Sciences Section
Technical Report #116

Margaret McLaren
January 2000

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Introduction

White-tailed deer (*Odocoileus virginianus*) are the most abundant ungulate species in Ontario and are capable of rapid population growth. In the absence of significant predation, they can readily outstrip the capacity of their habitat, particularly in central Ontario where they congregate in traditional wintering areas. On the other hand, winters with heavy snow, especially when followed by a cold spring can result in substantial mortality.

Management of deer numbers occurs primarily through manipulation of harvest by recreational hunters. While the goals of management may vary, the objective in central Ontario is to maintain deer herds at population levels below 100% of the biological carrying capacity of the winter range. Carrying capacity is defined as the maximum number of deer a wintering area can support on a continuing basis without habitat damage. At this population level, habitat damage is minimized and productivity of the herd remains high allowing for long term availability of deer for both consumptive and non-consumptive uses.

In southern Ontario, *social carrying capacity* may be lower than biological carrying capacity. *Social carrying capacity* encompasses considerations such as, acceptable levels of agricultural damage and, ensuring that the number of collisions between deer and vehicles remains reasonably small.

Maintaining a deer population within either biological or social carrying capacity is easier said than done. Methods to estimate deer numbers are expensive to implement and tend to produce significantly inaccurate or inconsistent results. Because deer cannot be readily counted, research conducted in Ontario and elsewhere has focused on understanding the relationships between deer productivity and habitat, and on the development of decision support models. The Deer Harvest Management Decision Support System (DHMDSS), in combination with the Ontario Deer Model (ODM) (Broadfoot and Voigt 1992) are the primary decision support tools recommended for use by Ontario deer managers.

Deer populations in Ontario are strongly influenced by availability of winter habitat. Even in southern Ontario, where deer have access to agricultural lands for feeding, they are largely restricted to the immediate vicinity of wooded areas in winter, and tend to use the same areas year after year. In central Ontario, deer migrate to traditional wintering areas known as *yards*. Both ODM and DHMDSS require an estimate of area used by deer in winter and carrying capacity of that winter area. The purpose of this document is to provide a plan that outlines frequency of surveys and funding required to complete those surveys for measuring winter range size in central and southern Ontario and carrying capacity of winter range in central Ontario. Methods for measuring carrying capacity of winter range in agricultural areas have not been fully developed. The plan does not include consideration of deer habitat in northwestern Ontario because habitat is not considered to be limiting deer populations in that part of the province.

Economic Impacts

In 1993, deer hunting generated $3.6 million in licence revenues. In the same year (the most recent year of analysis), direct expenditures by hunters totaled $56.8 million. In terms of value added, these expenditures contributed $89.9 million to Gross Provincial Income (GPI), which generated 1670 person-years of employment and $61.1 million in labour income. Deer hunting also generated $32.7 million in tax revenues (Legg 1995). These values are substantial and do not include any consideration of economic activity associated with non-consumptive use of deer (e.g. travel to certain provincial parks to see deer).

In 1997, the Ontario Ministry of Natural Resources (OMNR) began a review of the deer program with a view to enhancing hunting opportunities and increasing economic benefits within the sustainable limits imposed by deer population levels and reproductive output. While this review may result in changes that increase revenues to OMNR, such changes may also result in both qualitative and quantitative changes in the information needed for management decisions.

Current regulations allow an individual hunter to hold only one deer licence and one game seal. If future regulations allow hunters to buy more than one licence and take more than one deer, the probability that harvests will approach or exceed the sustainable limit is increased. The only part of the province where allowing hunters to buy more that one licence is under consideration is southern Ontario, and particularly southwestern Ontario where deer populations are high. Until now, gathering of harvest statistics has been emphasized over collection of habitat information in southern Ontario. As harvests approach sustainable limits better information on habitat, and particularly winter habitat, will become more important to sustainable management.

Why Do We Need a Plan?

Throughout Ontario, deer winter in more or less traditional areas of forested habitat. South of the Precambrian Shield and in agricultural areas of northwestern Ontario, deer tend to winter in relatively small groups and often feed on waste grain or other foods of agricultural origin near their primary forested wintering area. In central Ontario, the migration to defined wintering areas is more pronounced. Most deer in any WMU winter in just a few locations and, in the largest deer yards, as many as 15,000 deer may be found in an area one tenth of the area occupied in summer.

Deer yards are traditional but they are not static. While the same general area is used from year to year, conditions encountered by deer in a particular year will dictate the specific area used. In years of exceptionally light snow, deer may not concentrate in traditional yards as much as usual and a succession of years with light snow may allow new yards to form. However, population growth in new yards, is slow.

Land use or land management changes can also affect conditions in deer yards. Deer need coniferous cover and sufficient food. Since food is usually provided by young tree and shrub growth, some forestry activities within the yard can be

beneficial. Guidelines for management of deer yards during forest management planning and operations on Crown land have been in place since the late 1980s. These guidelines allow managers to protect coniferous cover and to stimulate browse production when necessary, to provide additional winter food for deer. Deer yards on private land, where OMNR has little influence, are at risk of excessive or no harvest of cover trees. Without some cutting, little browse is produced.

During the 1970s and 1980s, OMNR field staff in most Districts within deer range surveyed their districts every two to three years to identify wintering areas used by deer. Often these areas were managed by breaking trails and cutting browse for deer. These practices, along with supplementary feeding of deer with grain, sometimes resulted in growth of deer populations above the level that yards could support under natural conditions.

Since the late 1980s, changes in administrative structures, changes in funding approaches and changes in philosophy have altered the way deer yards are managed. The Cooperative Deer Study, lead by OMNR researchers, demonstrated the long-term dangers to deer habitat of maintaining populations at an artificially high level through supplementary feeding. The Cooperative Deer Study also resulted in the development of the Ontario Deer Model.

At the same time as research from the Cooperative Deer Study was being transferred into guidelines and tools for deer managers, organizational changes resulted in lowered ability of field staff to obtain the necessary information to use the tools. Particularly in the past five years, staff reductions and changes in funding approaches have made it difficult for field staff to maintain required habitat information. A provincial funding approach for wildlife inventory has been implemented in an attempt to ensure that data are collected in a consistent manner. However, in the absence of a provincial plan for collection of deer habitat data, the Provincial Inventory Committee has not had the necessary background to distribute funding appropriately. This document is intended to remedy that situation.

Principles

This plan is based on the following principles:

1. OMNR corporate policy, as set out in Directions '90s...Moving Ahead 1995 (OMNR 1994), and Beyond 2000 (OMNR 1998) requires adequate information be available to ensure sustainability of current uses and to assess risk to sustainability of enhanced uses.

2. Responsible management of deer populations through recreational hunting requires an adequate understanding of the relationship between population levels of deer and both quantity and quality of habitat.

3. Deer are an important component of Ontario ecosystems. Information about significant deer habitat is needed to ensure appropriate consideration of deer habitat in land use planning decisions even in the absence of recreational hunting.

Thus, provision is made in this plan for surveys of WMUs with no open season for deer.

4. Surveys must be carried out in accordance with established guidelines both for assessing geographic extent of deer yards and measuring browse availability (Buss *et al.* 1998, Broadfoot and Voigt 1996).

Information Requirements in Relation to Management Risk

Risk in deer management has two components:

1. The risk that deer will become excessively abundant. *Excessively abundant* includes both the situation where deer exceed biological carrying capacity and, in agricultural areas, where the population exceeds *social carrying capacity*.

2. The risk that excessive harvest will depress the population to such an extent that recovery is slow.

Local harvest decisions may range from harvesting a large number of deer to protect habitat from damage to harvesting a very small number of deer to allow the population to grow. In either case, managers need information about extent and quality of winter habitat to make appropriate harvest decisions.

In deer range on the Canadian Shield, most deer winter in defined and traditional yards. Appendix 1 summarizes information obtained for deer yards as defined by District staff for WMUs 36-63 and 83. Aerial surveys are used to define the core areas (which may change over time) of these yards and to identify newly formed yard areas. Browse surveys of yard areas provide an estimate of carrying capacity of the habitat and can also be used to estimate how close the deer population is to carrying capacity (Broadfoot and Voigt 1996).

In the fragmented landscapes of southern Ontario, deer are found in most forest patches and will also use adjacent agricultural fields for feeding. While there may be some movement of deer to preferred areas of winter habitat in southern Ontario, migration is much less pronounced than in central Ontario. Aerial surveys of forest patches throughout each WMU are required to assess winter use by deer. Browse surveys are not planned for southern Ontario. This technique is not cost-effective when deer are scattered in many small forest patches. Deer in many parts of southern Ontario supplement their diet with waste agricultural crops. Work is ongoing to develop methods for estimating carrying capacity of deer range in southern Ontario (J. Broadfoot, in prep.).

While there are guidelines for how data should be collected, there are no OMNR corporate standards for how often deer yard information is needed. For purposes of planning, this report assumes that the geographic extent of deer wintering areas should be determined at least every five years and that browse availability in central Ontario deer yards should be assessed in yards supporting more than 500 deer at least every 10 years. The selection of 500 deer and 10 years is somewhat arbitrary. Certainly, there are yards supporting fewer than 500 deer that make a significant contribution to local deer population. However, it was felt that conducting browse surveys in smaller yards would not be cost-effective. The 10-year

schedule for browse surveys is considered a minimum standard. Some yards where deer populations are changing rapidly may require browse surveys more frequently.

Allocation of Funding

Costs to implement this plan are approximately $120 thousand per year. Appendix 2 provides details of how this cost estimate was made.

Although this plan has made assumptions about the average frequency of surveys, many factors will affect actual frequency. Factors include availability of time for local staff to implement surveys in any particular year, local assessment of the need for a survey, and availability of suitable snow conditions for surveys of geographic extent of deer wintering areas. Applications for funding will be solicited during work planning each year. Allocation of funding will be made according to the following priorities.

Setting Priorities

Applications for central funding of deer winter habitat surveys will be required to include the number of years since the previous survey, and an assessment of management risk as defined by the DHMDSS. DHMDSS defines risk based on current deer density (in relation to population target), trend in deer population, and harvest demand. Risk may be high because of high harvest demand combined with low deer populations (and the possibility of further depressing deer populations) or because of high and growing deer populations with low harvest demand (leading to over-population and habitat damage). The second scenario is more important relative to assessing winter habitat availability and quality.

Priorities will be set as follows:

1. First priority for **geographic extent (aerial) surveys** will be given to WMUs with the least recent existing survey.

2. First priority for **browse surveys** will be given to WMUs with high management risk due to high deer populations, and an existing browse survey (if any) that is 10 or more years old.

3. Second priority for browse surveys will be given to yards that have no existing quantitative browse information.

4. Additional browse survey allocations will be made based on least recent to most recent existing surveys.

Conclusion

Yearly cost for obtaining information on winter distribution of white-tailed deer and winter habitat condition across central and southern Ontario is estimated at about $120 thousand. This amount represents less than 3% of the value of licence sales for information vital to the sustainable management of Ontario's deer herds.

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Appendix 1. Summary of deer yard information for WMUs 36 to 63 and 83

Information on location, size, ownership, and condition of known deer yards (Table 1) was collected through discussion with District staff. The quality of information available varied from District to District and also from yard to yard within a District. Variability was the result of a number of factors including whether the yard was on private or Crown land, differing emphasis on deer management (which, in turn, depended on harvest demand in relation to deer available), and differing funding levels. Even the definition of a *yard* varies somewhat from north to south. In the north, deer are usually concentrated in a few areas during winter and *yards* that support as few as fifty deer may be defined. In the south, deer movement is often not as restricted by deep snow and only areas where substantial numbers (e.g., one hundred or more) of deer concentrate may be defined as *yards*, even though other small areas may support twenty to one hundred deer over the winter.

Sault Ste. Marie (including Blind River Area) (WMUs 36, 37 (part) and 45)

Three large and two small deer yards were identified in Sault Ste. Marie District. The Desbarats Complex has gradually moved southwards since the 1960s. St. Joseph's Island supports about three thousand deer, and is entirely on private land. Part of the St. Joseph's Island yard is severely degraded by harvest of coniferous cover, mainly cedar. The Iron Bridge yard supports between three thousand and thirty five hundred deer.

Sudbury (including Espanola) (WMUs 37 (part), 42, 43A, 43B)

Most of the deer in Sudbury District are on Manitoulin Island. The Manitoulin population grew substantially in the 1980s and early 1990s and is now in the vicinity of twenty thousand animals. The yard is almost entirely on private land and is in fair to good condition.

On the mainland, there are two yard areas, each supporting between five hundred and a thousand deer, south and southwest of the town of Espanola (Willisville and Lacloche yards). A number of other small yards exist along the Highway 17 corridor and in the Killarney area. These yards are unusual in comparison with other Ontario deer yards in that they are located in rugged terrain where wind sweeps the snow clear to allow deer movement. Most of the North Shore yards are on Crown land.

North Bay (WMU 47, 48)

Loring deer yard, one of the two largest yards in Ontario is located in North Bay District. Loring supports about ten to fifteen thousand deer. At this population level, the yard is supporting more than the estimated maximum winter carrying capacity of 10,000 deer. The Mattawa deer yard is considerably smaller.

Table 1.Summary of characteristics of primary deer yards in central Ontario. Note that both the estimate of current numbers and the estimate of winter carrying capacity are frequently very rough approximations.

District/Area	WMU	Deer yard	Approx. size (km^2)	Approx. # of deer (current estimate)	Carrying capacity	Approx. amount of private land	Current Condition, Comments
Sault Ste. Marie	36	Searchmont	N/A	0 (historic use)			
	36	Airport		20-50	?	?	Good
		Desbarats Complex	500	1000	?	Most of yard	Browse:poor–fair Cover: fair-good
	45	St. Joseph I.	690	3000	?	100%	Fair-good
	36	Thessalon		50-100	?	?	Good?, new yard
Blind River	37	Iron Bridge	100	3000-3500	?	>50%	Fair?
Espanola	37/42	Webbwood/La Cloche/Willisville	125	300-1000	2000?	Little	Good
	43A,B	Manitoulin I.	1900	20,000	20,000	100%	Fair-good
	44	Cockburn I.	450	?	?	100%	
North Bay	47	Loring	600	10,000-15,000	10,000	30%	Fair-good
	48	Mattawa	115	?	?		
Parry Sound	46	Healy	160	325	700	5%	Good
	46	Killbear	100	600	600	65%	Cover good, browse fair
	46	Six Mile Lake	100	?	?	10%	
	46	Galla Lake	100	?	500	5%	Cover good, browse fair
	49	Chikopi	40	650	450	75%	Cover good, browse fair
	49	Oranmore	65	600	925	90%	Good
	49	Shawanaga	75	700	1100	0%	Good
	49	Mary Jane	80		260	75%	Cover good, browse fair
	49	Seguin	80	?	?	40%	Fair
Bracebridge	53	Stisted	54	400	500	85%	Fair
	53	Lake of Bays	68	800	1000	70%	Good
	53	Muskoka Lakes	200	1000	1000	100%	Poor

Table 1.(continued) Summary of characteristics of primary deer yards in central Ontario.

District/Area	WMU	Deer yard	Approx. size (km^2)	Approx. #.of deer (current estimate)	Carrying capacity	Approx. amount of private land	Current Condition, Comments
Bracebridge	46	Wood Twp.	24	500	700	15%	Good
	53	Jerry/Walker Lake	30	300	400	100%	Fair
	53	Other small yards		100s	?	50-100%	Good
	50	Many small yards		?			
Minden	56/60	Nogies	160		1000	57%	
	54	Hindon	200		2500	9%	Good
	56	Percy	50		1400	100%	Good
	56	Carden	50	<1000		100%	Poor
Bancroft	57	Papineau-Carlow	120	500		50%	Good
	57	Watt-Baptiste	150	~1000	~1000	40%	Good
	57/61	Egan-Mephisto–Jamieson Lake	250	>1000	>1000	60%	Good
	60	Eels Lake	50			50%	Good
	60	Peterborough Crown Game Preserve	250	~500		50%	Poor
Bancroft	63	Snow Road	150	~2000	2000	60%	Fair
(Mazinaw)	63	Canonto	200	~4000	4000	5%	Fair
	61	Effingham	70	~2000	2000	5%	Browse: poor Cover: good
	61	Millbridge	120	1500-2000	2000	95%	Fair
Pembroke	55B	Round Lake/ Germanicus			1200	90%	Poor over-browsed in 1980s
	58/59	Gratton/ other small yards	785	?	?	50%	
Owen Sound	83	Johnson Harbour	55	500-750	~950	37%	Good
	83	Greenough Har./Pike Bay	11	400-500	?	100%	Fair-good
	83	Boat Harbour	20	700-900	?	60%	Fair-good

Parry Sound (including Bracebridge) (WMUs 46, 49, 50, 53)

Parry Sound has six deer yards capable of supporting about five hundred to one thousand deer each. In addition, a number of other deer winter areas that likely support low hundreds of deer have not been fully evaluated for winter carrying capacity.

Bracebridge has a number of small to medium yards in WMU 53 as well as numerous small pockets in WMU 50 where a few deer winter. The yards supporting the largest numbers of deer are primarily on private land along the shores of Lake Muskoka and Lake of Bays. With the exception of the Muskoka Lakes yard, yards in Bracebridge are in fair to good shape with deer populations estimated to be at or somewhat below winter carrying capacity.

Bancroft (including Minden) (WMUs 54, 55A, 56, 57, 60, 61)

Minden has four large yards as well as a number of smaller areas where small numbers of deer winter. Three of the four large yards are in good shape with abundant browse and good cover. Carden yard is the smallest yard in Minden and is the poorest of the four. The Mazinaw Area also has four major yards, none of which is in good condition and all of which have deer populations at or above carrying capacity. Bancroft Area has two yards supporting more than one thousand deer each and two yards, including the Peterborough Crown Game Preserve, that currently support about five hundred deer. In the mid 1980s the Peterborough Crown Game Preserve supported about five thousand deer (Bellamy 1986) but was severely over browsed and now is in very poor condition.

Pembroke (WMUs 55B, 58, 59)

Most information is available for the northern part of Pembroke District. The Round Lake Yard was seriously over-browsed in the 1980s when the deer population was more than twice the estimated winter carrying capacity. The nearby Germanicus yard is in better condition. Browse surveys were completed in both of these yards in 1990. A substantial number of deer winter in southern portions of Pembroke District but are usually not highly concentrated. Wintering areas in southern portions of the district have not been surveyed since 1981.

Appendix 2. Details of Cost Estimate for Deer Winter Range Surveys

The following sections give details of calculations of costs for aerial surveys of the geographic extent of deer wintering areas, and for browse surveys. Calculations of costs for geographic extent are estimated separately for central Ontario and southern Ontario because the underlying assumptions are different. Costs for browse surveys are estimated only for central Ontario for the reasons given above.

Estimates in Tables 2-4 are not meant to be taken as the actual costs of doing the respective survey a particular WMU. It is fully expected that costs may be more than shown in some units and less in others. The tables are intended to demonstrate the overall thinking that went into estimating the total yearly amount that is needed to maintain adequate information about deer habitat.

Table 2. Estimated costs to survey WMU's 36-37 and 43-61 for deer wintering areas.

WMU	Area	Estimated km of transect	Hours at 160 km/h	Est. ferry time	Total time	Cost @$400/h
36	500	450	2.8	1.0	3.8	$1,525
37	600	540	3.4	0.5	3.9	$1,550
43A	1700	1530	9.6	2.0	11.6	$4,625
43B	4500	4050	25.3	5.0	30.3	$12,125
44	450	405	2.5	1.0	3.5	$1,413
45	575	518	3.2	1.0	4.2	$1,694
46	4100	3690	23.1	5.0	28.1	$11,225
47	4500	4050	25.3	5.0	30.3	$12,125
48	3950	3555	22.2	4.0	26.2	$10,488
49	3800	3420	21.4	4.0	25.4	$10,150
50	1700	1530	9.6	2.0	11.6	$4,625
53	2400	2160	13.5	2.0	15.5	$6,200
54	1675	1508	9.4	2.0	11.4	$4,569
55A	900	810	5.1	1.0	6.1	$2,425
55B	1300	1170	7.3	1.0	8.3	$3,325
56	2500	2250	14.1	2.0	16.1	$6,425
57	1875	1688	10.5	2.0	12.5	$5,019
58	2000	1800	11.3	2.0	13.3	$5,300
59	1875	1688	10.5	2.0	12.5	$5,019
60	4225	3803	23.8	4.0	27.8	$11,106
61	2500	2250	14.1	3.0	17.1	$6,825
Total		41872.5	261.7	50.0	311.7	$124,681

Table 3. Estimated costs to survey deer wintering areas in WMUs 62 and 64-94.

WMU	Km² Forest	Hours @40 km²/h	Cost @$600/h
62	1115	27.9	$16,725
64	1243	31.1	$18,645
65	2126	53.2	$31,890
66	756	18.9	$11,340
67	1758	44.0	$26,370
68	905	22.6	$13,575
69	355	8.9	$5,325
70	256	6.4	$3,840
71	274	6.9	$4,110
72	330	8.3	$4,950
73	751	18.8	$11,265
74	505	12.6	$7,575
75	575	14.4	$8,625
76	1358	34.0	$20,370
77	289	7.2	$4,335
78	913	22.8	$13,695
79	200	5.0	$3,000
80	467	11.7	$7,005
81	412	10.3	$6,180
82	1334	33.4	$20,010
83	1169	29.2	$17,535
84	500	12.5	$7,500
85	570	14.3	$8,550
86	174	4.4	$2,610
87	369	9.2	$5,535
88	68	1.7	$1,020
89	391	9.8	$5,865
90	748	18.7	$11,220
91	258	6.5	$3,870
92	619	15.5	$9,285
93	401	10.0	$6,015
94	98	2.5	$1,470
Total			$319,305

Table 4. Estimated costs for browse surveys.

District	WMU	Deer yard	Last Done	Est. Carrying capacity	Survey cost
Sault Ste. Marie	36	Desbrats Complex	?	~1000	$8,400
	45	St. Joseph's I.	1996?	3000	$3,000
Blind River	37	Iron Bridge	?	3000	$8,400
Espanola	43	Manitoulin I.	1996-1998	20000	$18,000
North Bay	47	Loring	1997?	10000	$15,000
	48	Mattawa	?	?	$8,400
Parry Sound	46	Healy	1995	700	$8,400
	46	Killbear	1997	600	$8,400
	46	Galla Lake	1997	500	$8,400
	49	Chikopi	1994	500	$8,400
	49	Oranmorne	1994	925	$8,400
	49	Shawanaga	1995	1100	$8,400
Bracebridge	53	Lake of Bays	1991	1000	$8,400
	53	Stisted	1991	500	$8,400
	46	Wood Twp.	?	700	$15,000
Minden	56	Percy	1995	1400	$8,400
	54	Hindon		4200	$8,400
	56/60	Nogies	mid-80's	1000	$8,400
	56	Carden	?	<1000	$8,400
Mazinaw	61	Effingham	1993?	~2000	$8,400
	61	Millbridge	1993?	1500-2000	$8,400
	63	Canonto	1991?	~4000	$8,400
	63	Snow Road	?	~2000	$8,400
Bancroft	57	Watt-Baptiste		1000	$8,400
	57	Papineau-Carlow	1993	500?	$8,400
	57/61	Egan-Mephisto--Jamieson Lake	1994	>1000	$8,400
	60	Peterborough Crown Game Preserve	1993	500-1000	$8,400

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Table 4. Estimated costs for browse surveys (continued).

District	WMU	Deer yard	Last Done	Est. Carrying capacity	Survey cost
Pembroke	55B	Round Lake/Germanicus	1990	1200	$8,400
	58/59	Gratton	?	?	$8,400
Owen Sound	83	Johnson Harbour	?	~900	$8,400
	83	Grenough Har./Pike Bay	?	?	$8,400
	83	Boat Lake Har.	?	?	$8,400
Total					$286,200

Estimating the Extent of Habitat Used by Deer in Winter

Central Ontario

In central Ontario deer winter in major yards and, in some parts of the area, numerous small concentration areas, which collectively may harbour as many deer as some of the major yards. Although the general locations of major yards are known, boundaries of yards change over time. Periodic updates are needed for assessing boundaries. In WMUs where scattered concentration areas outside of major yards occur, a survey of the full WMU is periodically needed to establish the locations of these other concentration areas.

In estimating costs for surveys in central Ontario, this report assumes that only yard areas will be surveyed in WMUs 36, 37 and 42. For WMUs 43-61 it is assumed that the entire WMU will be surveyed using transects 1 km apart as directed by the guidelines for assessing deer wintering areas (Buss *et al.* 1998). Aircraft time has been estimated based on a flight speed of 160 km/h. Cost has been estimated at $350/h. This is a compromise between cost of using an OMNR turbo beaver and other small fixed-wing aircraft. Depending on local aircraft availability either one may be used. Table 2 shows costs for individual WMUs and the total for all WMUs. Assuming that 20% of central Ontario is surveyed each year, yearly funding requirements are $25,000.

Southern Ontario

In southern Ontario, winter habitat varies from relatively contiguous forest in a few WMUs to extremely fragmented forest patches in others. Distribution of forest patches substantially affects flight time required to assess deer wintering areas. Local staff across southern Ontario estimated survey times varying from 16 km² of forest habitat per flight hour to 75 km² of forest habitat per flight hour with most estimates in the range of 35-50 km² of forest habitat per flight hour. For overall cost estimation, 40 km² of forest habitat per flight hour was used. Area of forest habitat was based on remote sensing data as recorded on the Ontario Deer CD-ROM (v.1, January 1999). Aircraft costs were estimated at $600/h, a com-

promise between fixed-wing cost and helicopter cost. In some parts of southern Ontario, particularly where distinction between coyote tracks and deer tracks must be made, use of a helicopter may be necessary. Table 3 shows the costs for individual WMUs and total for all WMUs. Assuming that 20% of the area is surveyed each year, yearly funding requirements are $64,000.

Estimating Winter Carrying Capacity

Browse surveys to estimate carrying capacity are planned only for central Ontario. Time required and, therefore, cost of estimating carrying capacity can vary substantially among yards depending on the number of habitat types present, density of stems on selected plots and accessibility. In determining costs for browse assessment it was assumed that all preparation (assessment of habitat types, selection of stands to be surveyed) would be done in-house. Costs for the field portion of the assessment were determined through a combination of estimates provided by District staff and calculations based on the following assumptions:

- 42 plot clusters will be surveyed in each yard (i.e. 6 of the 8 possible habitat types are present)
- a crew of two can survey an average of 2.5 plot clusters/day when assessing carrying capacity (i.e. counting stems and clipping stems for weighing) and 5 plot clusters/day when assessing browse consumption (i.e. clipping stems only).
- contractors charge $250 per person per day.

These assumptions were used in Table 4 unless local staff had provided a different estimate. Assuming each yard is surveyed once in 10 years, yearly cost for browse surveys will be $29,000.